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GEOPHYSICAL ABSTRACTS

NO. XXXVIII

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

GEOPHYSICAL ABSTRACTS[1]

No. 38

Compiled by Frederick W. Lee[2]

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1. GRAVITATIONAL METHODS

(794) EIN STATISCHER SCHWEREMESSER

(A STATICAL APPARATUS FOR GRAVITY MEASUREMENTS)

By H. Haalck

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 17-30.

In a previous article published under the title of "Ein statischer Schweremesser" (see Geophys. Abs. 23, p. 62) the author had shown that the question of the development of a statical apparatus for gravity measurements was brought very close to its solution and that therefore further experiments could be carried on with the hope of solving this problem definitely.

In this article Haalck describes the construction of an improved instrument by which practical measurements of the terrain could be made.

Contents of the article:

1. Fundamental principles for constructing apparatus for gravity measurements: (a) Dynamic methods; (b) static methods.

2. Theory of the barometric principle.

3. Methods for obtaining the necessary sensitivity.

4. Reading device.

5. Arrangement of levels and foot screws.

6. Influence of temperature changes upon the readings.

7. Elimination of the influence of temperature.

The purpose of Haalck's investigations is to develop an apparatus for gravity measurements by which the difficult and complicated methods of pendulum measurements can be replaced by quicker and simpler methods.

The article is to be continued.--W. Ayvazoglou.

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(795) RECHERCHES SUR LES FILS D'ÉLINVAR

(INVESTIGATIONS ON ELINVAR WIRES)

By Boris Perebaskine

Annuaire de l'Institut de Physique du Globe, 1928.

The work described concerns investigations on elinvar wires carried out by B. Perebaskine, under the direction of M. Rothe, especially with regard to the influence of the temperature. Two wires, one 0.08 millimeter in cross-section and 66 centimeters long, and the other 0.08 millimeter in cross section and 20 centimeters long, were examined during 40 days. Temperature changes were of the order of 7° C. The equilibrium was affected only by reason of untwisting of the wire. This could certainly be avoided by careful manufacturing of the wire. The results of examinations carried out in a room heated to a temperature not over 57° C. are given in a table. The coefficient of elasticity was equal to 4.54.

The figures given in the table concern a wire of 0.08 millimeter in cross section and 66 centimeters long; they show clearly that untwisting was influenced by the time, but that during the same period of time the wire was only very little affected by temperature; the mean value of the duration of oscillations was equal to about 8 minutes and 35 seconds.

From the observations the author draws the conclusion that during a series of measurements carried out with Eötvös' torsion balance the influence of temperature can be greatly reduced if an elinvar wire of proper constitution and dimensions, similar to that examined, is used.--W. Ayvazoglou.

(796) BEITRAG ZUR THEORIE UND PRAXIS DER REFERENZPENDEL-MESSUNGEN UNTER ANWENDUNG VON MINIMUMPENDELN

(CONTRIBUTION TO THE THEORY AND PRACTICE OF REFERENCE-PENDULUM MEASUREMENTS BY USING MINIMUM PENDULUMS)

By A. Berroth

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 30-39.

In this article the author discusses the possibility of eliminating the time scale of the absolute measuring system in which, according to the old methods, the time of oscillations of a pendulum must be expressed by introducing a reference-pendulum (in practice several) which is used as a stationary pendulum and is observed simultaneously.

Theoretical principles of the reference-pendulum measurements are examined and a method showing how minimum pendulums can be used is developed.

In conclusion a numerical example is given.--W. Ayvazoglou.

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(797) SCHWERE UND GEOID BEI ISOSTASIE

(GRAVITY AND GEOID IN THE ISOSTASY)

By Karl Jung

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 40-52.

Isostatic anomalies calculated in the usual way differ slightly from zero, as also does the isostatic structure of the earth's crust, because the geoid undulations are not taken into consideration in making the reduction for the level, and the relation between the surface relief and density (Pratt), respectively, and the surface relief and thickness of the earth's crust (Airy), which forms the basis for the reduction of masses, is not strictly correct owing to the convergence of the earth's radii and an irregular gravity in the earth's crust.

Spherical function developments for the geoid undulations, the free-air anomaly, and the isostatic anomaly in case of the isostatic structure of the earth's crust as determined in the usual way, are calculated, then numerical values are found up to the spherical function of the seventh order and represented in three figures.--Author's abstract translated by W. Ayvazoglou.

(798) A NEW INSTRUMENT FOR MEASURING VERY SMALL DIFFERENCE IN GRAVITY

By Kenneth Hartley

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 123-130.

Description of a new portable instrument for measuring relative values of gravity to within 2 or 3 parts in 10 million, specially designed for geophysical exploration. The principles of the design are analysed and the methods for eliminating effects of elastic hysteresis, temperature changes, variations in the barometric pressure, etc., are discussed. Also effects of initial stresses in materials, defects in alignment of locking mechanism, inaccurate leveling, etc. These difficulties are serious but seem to have been overcome. Results of preliminary field measurements near Houston, Tex., are presented and some comparison is made between the type of information given by this instrument and by the torsion balance.--Author's abstract.

(799) CHARTS FOR TORSION BALANCE READINGS

By M. M. Slotnick

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 131-133.

The calculations necessary to determine the values of the gradient and curvature quantities from the readings taken at a torsion balance station involve either slide-rule or logarithmic manipulations. The author shows here that the result obtained by writing the equations involved in linear forms of the type given in this article is well within the accuracy of the instrument.

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A pair of charts can readily be made for each instrument when used in 720 azimuth settings and another pair for 120° azimuth settings. Two charts made for field use for a Bamberg instrument for the 120° of settings are appended and the equations for this particular instrument in this case are given.--W. Ayvazoglou.

(800) THE EFFECT OF HEAT TREATMENT OF FINE METALLIC SUSPENSIONS

By N. N. Zirbel

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 134-138.

When a suspended system is supported by a fine wire the equilibrium position usually changes slowly for a long time after the load is applied. The equilibrium position also changes with temperature. It is found that both of these disturbing factors can be eliminated by a suitable heat treatment of the wire. Observations have been made on tungsten and platinum-iridium wires of sizes suitable for use in the Eötvös torsion balance. Apparatus and procedure, as well as the results obtained from the experiments, are discussed.--Author's abstract.

2. MAGNETIC METHODS

(801) ÜBER REMANENTEN MAGNETISMUS VON GESTEINEN

(ON THE REMANENT MAGNETISM OF ROCKS)

By J. Koenigsberger

Gerlands Beiträge zur Geophysik, Leipzig, vol. 35, No. 2, 1932, pp. 204-216.

The question of the remanent magnetism of rocks is discussed under the following headings:

1. Relative remanence of rocks in natural conditions and after being heated in laboratorium in the earth's field: Values for a series of rocks investigated are given.

2. Causes of a relatively small remanence: The following main reasons are mentioned: (a) Displacements inside of rocks at a temperature at which, as well as below which, no magnetism worthy of notice is produced; (b) displacements in rocks at temperatures above 400°; (c) various ages of eruptive rocks; (d) oscillations and repeated heating and cooling; (e) coercive force.

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3. Components of magnetization and constancy of the initial permeability: Corresponding to the constancy of the initial permeability the remanence is, in case of low field forces, proportional to them (± 3%). The vectorial resolution of the remanent magnetization into components was proved to be possible.

4. Demagnetization in the earth's field at temperatures below 585°: According to the experiments a temperature of about 500° is sufficient to produce in the earth's field a reversal magnetization.

5. Influence of the period of time of the magnetization and of the demagnetization on the remanence: It is proved by the experiments that time has influence upon the origin of the magnetization and its disappearance, as well as upon the reversal magnetization.--W. Ayvazoglou.

(802) ZUR HAALCKSCHEN THEORIE DES ERDMAGNETISMUS

(CONCERNING HAALCK'S THEORY OF EARTH MAGNETISM)

By T. Schlomka

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 84-87.

The author points out that errors have crept into Haalck's theory of earth magnetism. According to Haalck's statement the conclusion must be drawn that, based on Haalck's theory, the revolving earth produces a magnetic moment of a unit of volume which is at least 10^{14} smaller than the mean magnetization density of the earth's body necessary for the explanation of the magnetic field which is really observed.--Author's abstract translated by W. Ayvazoglou.

An explanation concerning Schlomka's statement is given by H. Haalck in his "Erwiderung" (Answer), published in the same number of the Zeitschrift für Geophysik, p. 88.--W. Ayvazoglou.

(803) MAGNETIC SURVEYS OVER MINERAL, DIABASE, AND ARTIFICIAL DYKES

By A. S. Eve and D. A. Keys

The Canadian Mining and Metallurgical Bulletin, No. 239, March, 1932, pp. 119-125.

In this paper the authors examine magnetic surveys carried out with the modern Askania types of vertical and horizontal variometers over magnetic dyk in the Sudbury region. The interpretation of the results has been confirmed by diamond drilling in some cases, and by experiments over models. Curves representing vertical and horizontal variations are given. Directions and magnitude of resultant vectors of magnetic anomalies at points above a pyrrhotite-nickel dyke and a diabase dyke, indicating overburdens of approximately 140 feet and 600 feet, respectively, are drawn.--W. Ayvazoglou.

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3. SEISMIC METHODS

(804) UNITED STATES EARTHQUAKES, 1930

By Frank Newmann and R. R. Bodle

Coast and Geodetic Survey, U. S. Department of Commerce, Washington, D.C., Serial No. 539, 1932, 26 pp.

This publication includes earthquakes of regions under the jurisdiction of the United States, though for the Hawaiian and the Philippine Islands earthquakes of volcanic origin are not included and only severe earthquakes are included for the Philippine Islands, since reports are published in Manila Earthquakes adjacent to the United States and felt within its borders or those in the regions under its jurisdiction are described, except that, in a general description only is given of Canadian earthquakes felt within the United States, as details are available in the Canadian report. The principal earthquakes of the year which were widely recorded are given regardless of location, and instrumental details for these are included.

Four illustrations showing the areas affected by shocks are given in the article.--W. Ayvazoglou.

(805) EARTHQUAKE NOTES

By R. R. Bodle

Eastern Section, Seismological Society of America, Washington, D.C., vol. 3, No. 4, 1932, 12 pp.

The following articles are discussed in this issue:

1. The North Mississippi earthquake of December 16, 1931: The information used in compiling this preliminary report was obtained through the cooperation of postmasters, weather observers, and others. The final report on this quake will be published by the Coast and Geodetic Survey in "United States Earthquakes, 1931."

2. The Georgetown seismological observatory, by J. S. O'Connor. A description of the equipment and work of this observatory is given.

3. Mexico's first skyscraper and earthquakes: According to a recent report of the Department of Commerce, the first skyscraper in Mexico has been designed to withstand earthquake shocks with a maximum acceleration of 65 centimeters per second per second. The building is now under construction.

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4. A new vertical-component seismometer: A statement concerning this new Benioff vertical seismometer which has been developed at the Seismological Laboratory in Pasadena is given. Its advantages are enumerated.

5. Other points of interest -- The advisory committee report concerns devices designed in the Seismological Laboratory, such as: (a) An automatic switching device assigned to increase the brilliancy of the recording lamps during the brief interval of greatest motion while a quake is being recorded; (b) a "wave seismometer"; (c) a "seismic frequency meter."

6. A photocell attachment for seismographs, by John P. Delaney. The photocell alarm described in this article notifies the office in case the pendulum moves off its zero position, whether from accident or an earthquake, and it also makes possible the removal of the record before the long waves and maxima have obliterated the less obvious preliminaries in the case of serious eqrthquakes.

7. University of Wisconsin -- new station.

8. Two-hundred-ton dynamite explosion. Preliminary information on the explosion carried out by the Inland Lime and Stone Co. at Manistique, Mich., is given.

9. Earthquakes and building code. The building code recommended by the National Board of Fire Underwriters (fifth edition, completely revised, 1931)

10. Navy-Princeton expedition.

11. Santiago, Cuba, earthquake of February 3, 1932.

12. Items of interest. Some items in which members of the eastern section may be interested are mentioned.

13. Epicenters. A list of epicenters determined since the last issue of the Earthquake Notes is given.--W. Ayvazoglou.

(806) BLASTING IN SEISMIC WORK

Editorial note

Engineering and Mining Journal, New York, vol. 133, No. 2, 1932, p. 77.

Methods commonly used in shot planting in commercial seismology are described. A recent innovation in shot planting, according to the Atlas Powder Co., is the use of a portable rig for drilling holes from 60 to 100 feet deep and lowering the charge in torpedo-shaped cans. These holes do not crater and can be used repeatedly, although to use them over five or six times is not recommended.

A table which may be useful in calculating the desired charge for loading a deep hole is given.--W. Ayvazoglou.

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(807) UNTERSUCHUNG DER SCHALLAUSBREITUNG BEI UNTERWASSER EXPLOSIONEN

(INVESTIGATIONS OF SOUND PROPAGATION CAUSED BY UNDER-WATER EXPLOSIONS)

By W. Bettermann

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 1-16.

The headings of this article are as follows: (1) Purpose of the work; (2) apparatus; (3) place of experiments; (4) results of experiments carried out in the Baltic Sea; (5) interpretation; (6) process of the explosion; (7) experiments carried out in the laboratory; (8) gas bubble oscillations; and (9) theoretical considerations.

A translation of the author's summary reads as follows: Experiments were carried out in the Baltic Sea to determine the travel-time curves produced by underwater explosions of small charges. It was shown how the travel-times of a sound could be measured with great accuracy by using a 2-gram low-tension detonator fuse as a source of the sound and an apparatus for oscillographic registration at the receiving station. It was proved that the registered sound did not travel through the layers with higher sound velocity, as could be expected according to analogous experiments in seismics, but propagated in the water with normal velocity. Distances used for measurements were equal to 450, 2,000, and 5,000 meters; within these limits the travel-time curve was a straight line.

From the oscillograms the author determined that the detonation was not represented at the receiving station as a short and sharp sound, but that there were lasting oscillations similar to those of an echo. The duration of this echo increased with the increase of the distance. The first part of the sound curve was independent from the distance and frequencies of from 600 to 700 Hertz prevailed in this part of the curve, while in the second part of the curve the frequencies were mostly equal to 200 to 250 Hertz.

By experiments carried out in the laboratory it was proved that under the most different experimental conditions the gas bubble produced by the explosion was oscillating radially; the dependence of its oscillating frequency from the content of salt and from pressure was also measured.

A formula for the calculation of this frequency was derived empirically.--W. Ayvazoglou.

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(808) SEISMISCHE UNTERSUCHUNGEN DES GEOPHYSIKALISCHEN INSTITUTES IN GÖTTINGEN

(SEISMIC INVESTIGATIONS CARRIED OUT BY THE GEOPHYSICAL INSTITUTE IN GÖTTINGEN)

By F. Gerecke, H. K. Müller, A. Ramspeck, and R. Köhler

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 65-84.

The article consists of three main parts. Part I is entitled "Measurements Carried Out on the Rhone Glacier." Preliminary information concerning this part, the purpose of which was to carry out seismic measurements of the glacier bed and to study the propagation of the seismic energy by simultaneous registration of the components of the elastic waves by means of two similarly constructed horizontal seismographs and one vertical seismograph, is given in the following two chapters:

1. The travel-time curve, by F. Gerecke. The thickness of the ice was measured by means of five longitudinal profiles and one cross profile. The results for a fixed profile, calculated according to various methods, are given in a table. The curves are shown in a diagram.

2. Azimuth and the angle of emergence of the displacement of P and S, by H. K. Müller. The following items are considered: (1) Instruments; (2) examination of the instruments; (3) direction of the shock of P_1; (4) angle of emergence of P_1; (5) angle of emergence of P_{121}; (6) periods; (7) direction of oscillation of S_1; (8) amplitudes of S_1.

Part II. Shaking table for investigating seismographs, by A. Ramspeck. A description of a shaking table constructed by Ramspeck is given. The movements of the table, as well as those of the seismograph, are registered photographically. The effect produced by the movement is examined. A schematical design of the table and diagrams showing the registrations of shocks and periodical movements are given.

Part III. A new method for examination of seismographs, by R. Köhler. The author describes a simple method of examination by which the inert mass is forced to vibrate by means of a rotating flywheel provided with an eccentric additional mass. The observed amplitudes which are drawn as functions of the period give directly the true magnified curve of the seismograph; this is proved by calculation and experiments. The method is especially useful for determining the harmful natural vibrations of a seismograph.--W. Ayvazoglou.

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(809) VELOCITY OF ELASTIC WAVES IN GRANITE

By L. Don Leet and W. Maurice Ewing

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 160-173.

Items of the article:

1. Location.
2. Method.
3. Instruments.
4. Firing positions.
5. Quincy results.
6. Rockport results.
7. Westley results.
8. Average longitudinal velocity.
9. Analyses: Chemical; mineralogical.
10. Discussion: Seismic waves registered at La Courtine; comparison of laboratory and field results; relation between compressibility of granite and pressure.
11. Acknowledgments.

The velocity of elastic waves in granite was determined at Quincy and Rockport, Mass., and Westerly, R. I. The waves measured were generated by dynamite explosions. They were recorded by portable seismographs at distances ranging from 50 to 4,600 feet. The observed velocities for longitudinal waves were:

Quincy ..... 16,260 ± 70 ft./sec. or 4.96 ± 0.02 km./sec.x
Westerly .... 16,400 ± 120 ft./sec. or 5.00 ± 0.04 km./sec.
Rockport .... 16,670 ± 40 ft./sec. or 5.08 ± 0.01 km./sec.
Average ..... 16,530 ± 90 ft./sec. or 5.04 ± 0.03 km./sec.

x The ± values given in this paper are probably errors.

A three-component seismograph, used only at Quincy, recorded transverse waves, the velocity of which was 8,150 ± 90 ft./sec., or 2.48 ± 0.03 km./sec. From the two velocities determined at Quincy and the density of speciments taken from the shooting locations, 2.65 grams/cm.^{3}, values for the bulk modulus, K, compressibility, β, rigidity, μ, Poisson's ratio, σ, and Young's modulus E, were obtained as follows:

$K = 44 \pm 1 \times 10^{10}$ dynes/cm.^{2}; $\beta = 2.28 \pm 0.05 \times 10^{-12}$ cm.^{2}/dynes;
$\mu = 16.3 \pm 0.4 \times 10^{10}$ dynes/cm.^{2}; $\sigma = 0.333 \pm 0.005$;
$E = 43 \pm 1 \times 10^{10}$ dynes/cm.^{2}

The form of the time-distance curves, straight lines through the origin, indicated that the waves did not penetrate deeply. Accordingly, the values

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obtained are for pressures only of a few atmospheres. The bearings of these results upon earlier investigations of the elastic constants of granite are discussed. Although direct comparisons between laboratory and field results are not conclusive, they indicate that the Adams and Williamson curve is incorrect for pressures below 2,000 megabars, and that there is no marked difference between dynamically and statically determined compressibilities of granite.--Authors' abstract.

(810) ASYMMETRY OF SOUND VELOCITY IN STRATIFIED FORMATIONS

By Burton McCollum and F. A. Snell

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 174-185.

In the course of explorations of subsurface geology by the seismograph the authors have frequently observed the pronounced effect of stratification on the velocity of seismic waves in shales, and this effect has often been utilized in practical seismography.

Recently an opportunity was afforded for securing additional quantitative data on the velocity normal to and parallel to the bedding planes. The paper points out that the velocity parallel to the planes of stratification is, in some instances, as much as 50 per cent higher than the velocity in a direction normal to the bedding planes. It is shown also that inclined stratified beds exhibit a higher apparent point-to-point velocity when sound travels in an up-dip direction than when travelling down-dip. The paper describes a procedure whereby this effect may be utilized for determining the direction and approximate magnitude of the dip in such stratified deposits. The method has proved to be of considerable practical importance where the stratified formations are obscured by overlying deposits.--Authors' abstract.

(811) THE CALCULATION OF THE MOTION OF THE GROUND FROM SEISMOGRAMS

By H. A. Wilson

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 186-199.

The equation of motion of a mechanical seismograph is $-\ddot{x} = \ddot{y} + 2k\dot{y} + p^2 y$, where x is the ground displacement and y the seismograph deflection. This equation may be solved for y when x is supposed known or for x when y has been observed as a function of the time. In this paper both of these ways of solving the equation are considered. The motion of the seismograph due to a train of waves starting at t = 0 is considered and also the motion due to the arrival of a single wave. In each case seismographs with several periodic times and either undamped or critically damped are considered. Curves are given showing the motion of the ground and the calculated motion of the seismograph. The motion of the ground corresponding to several simple assumed seismograms is also worked out and shown by means of curves. The

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motion corresponding to a given seismogram depends greatly on the periodic time and damping of the seismograph. Finally the ground motion is deduced from two actual seismograms due to dynamite explosions. An integraph is described which enables the calculations to be done more quickly.--Author's abstract.

(812) POSSIBILITY OF FREE OSCILLATIONS OF STRATA EXCITED BY SEISMIC WAVES

By Katsutada Sezawa and Kiyoshi Kanai

Bulletin of the Earthquake Research Institute, Tokyo, vol. 10, No. 1, 1932, pp. 1-18.

In this paper the authors are dealing with the problem of transmission of seismic waves of oscillatory type and of finite extent through strata of different elasticities, densities, and thicknesses. Conclusions on the nature of the free vibrations of strata due to seismic waves, based on mathematical discussion, are derived.--W. Ayvazoglou.

(813) NOTES ON THE WAVES IN VISCO-ELASTIC SOLID BODIES

By Katsutada Sezawa

Bulletin of the Earthquake Research Institute, Tokyo, vol. 10, No. 1, 1932, pp. 19-22.

From the numerical examples given in this article Sezawa concludes that "It is ascertained that in the possible case of dispersion the waves are damped away during a very small fraction of a second; that is to say, they are damped in a short distance even within a fraction of the length of very short waves. Hence, it may be concluded that the waves, whose velocity is affected by the viscosity of the solid, can not be transmitted to any short distance, so that the investigation of the dispersion of waves due to its damping nature is obviously meaningless."--W. Ayvazoglou.

(814) STUDY ON THE PROPAGATION OF SEISMIC WAVES

By Hiroshi Kawasumi

Bulletin of the Earthquake Research Institute, Tokyo, vol. 10, No. 1, 1932, pp. 94-129.

The principal aim of this paper is the examination of new methods for studying the propagation of seismic waves.

Chapter 1 deals with the determination of the velocity of P-wave, from the analysis of travel-times of the earthquake on May 21, 1928, which occurred in Chiba prefecture (selection of the method; effect of the surface crust and reduction to the level surface of the ultra-basaltic layer; numerical calculation; discussion of the results).

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Chapter 2. Determination of the velocity of S-wave.

Chapter 3. Provisional calculation of time-distance curves for various hypocentral depths up to 500 kilometers.

In the appendix the author makes a reexamination of the velocity of P-wave and the accuracy of the values calculated in Chapter 3. The comparison of the results is given in tables.--W. Ayvazoglou.

(815) COMPARAISON ACCÉLÉROMÉTRIQUE DES SECOUSSES SISMIQUES DANS DEUX PARTIES DE LA VILLE DE TOKYO

(COMPARISON OF ACCELERATIONS OF SEISMIC SHOCKS IN TWO PARTS OF TOKYO)

By Mishio Ishimoto

Bulletin of the Earthquake Research Institute, Tokyo, vol. 10, No. 1, 1932, pp. 171-187.

In a previous paper (see Geophys. Abs. 34, p. 362) the author had shown that the seismic shocks observed on the surface of the earth do not have the characteristics of waves generated directly at the focus of an earthquake. These primary waves excite in the superficial layer secondary waves which constitute the greatest part of the record of a seismogram. This is proved especially by the records obtained in Hongo with the acceleration seismograph.

In this article Ishimoto gives a description of his observations on seismic shocks carried out in two parts of the City of Tokyo in order to compare their characteristics. Based on the results of these observations it was established that the seismic disturbances at two places were entirely different - the period, as well as the amplitude. Thus he draws the conclusion that the primary wave is an important factor by which the changes of the phase of the shock is caused but that the period, the amplitude, and the duration of the shock is determined entirely by the conditions of the superficial layer.

Curves and seismograms are added.--W. Ayvazoglou.

(816) A PORTABLE HORIZONTAL PENDULUM SEISMOMETER

By Fuyuhiko Kishinouye

Bulletin of the Earthquake Research Institute, Tokyo, vol. 10, No. 1, 1932, pp. 188-191.

A new portable seismometer constructed by the author which is lighter than those which have been made before is described. A photograph of the seismometer equipped with a synchronous motor for driving the recording drum is given.--W. Ayvazoglou.

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4. ELECTRICAL METHODS

(817) COMMUNICATION SUR LE CAROTTAGE ELECTRIQUE

(COMMUNICATIONS CONCERNING ELECTRICAL CORING)

By C. and M. Schlumberger

II-e Congres International de forage, Paris, September, 1929, pp. 1-14.

By "electrical coring" the authors designate an operation by which the nature of rocks opened by drilling can be determined inside of the untubed part of the well by means of electrical resistivity measurements. Therefore the purpose of this operation consists of geological investigation of the ground, similar to the "mechanical coring" ordinarily used.

The present communication is divided into three parts: The first deals with the resistivity of rocks in general, since these rocks are characterized by means of electrical parameters. In the second part the technique of the measurements adopted by the authors is discussed. Finally, in the third part the authors give a summary of the application of "electrical coring," as well as the results obtained from observations made in Pechelbronn, where this method was used regularly for more than one year.

Practical examples are shown in a series of diagrams of resistivity as determined for a number of boreholes.--Authors' abstract translated by W. Ayvazoglou.

(818) UNTERSUCHUNGEN ÜBER DIE ELEKTRISCHE RAUMLADUNG UND DAS ELEKTRISCHE FELD AM BODEN

(INVESTIGATIONS CONCERNING THE ELECTRIC SPACE CHARGE AND THE ELECTRIC FIELD ON THE GROUND

By Irmgard Hahnfeld

Zeitschrift für Geophysik, Braunschweig, vol. 8, No. 1/2, 1932, pp. 89-106.

Contents of the article:

1. Apparatus.
2. On the inertia of the radioactive probes.
3. Results of experiments of parallel registrations of the air potential and space charge on a platform and on the field.
4. Measurements carried out with an earth-charging apparatus and with a potential-probe.

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The purpose of the work consisted in investigating the relations between the electric space charge and the electric field on the ground. Photographically registered were:

1. The electric surface charge of the earth.
2. The electric space charge of the air.
2. The potential difference between the surface of the earth and one point in the air, h meters above the ground.

The translation of the author's abstract reads as follows: "An instrument for automatic registration of the earth's surface charge was constructed and parallel registrations of the air potential, space charge, and surface charge were carried out. The theory of the instrument was discussed; then, based on the potential theory, a layer of space charge on the ground was established by observations and its thickness (a few meters) was calculated. Inside of this a second layer a few decimeters thick and of ten times higher space charge density was supposed directly above the ground.--W. Ayvazoglou.

(819) SOME ASPECTS OF ELECTRICAL PROSPECTING APPLIED IN LOCATING OIL STRUCTURES

By Leo J. Peters and John Bardeen

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 103-122.

Electrical prospecting is defined as the science and the art of determining the variations of the electrical constants (resistivity, magnetic permeability, and the dielectric constant) of the earth's crust and of interpreting these variations in terms of geological structure. The most successful systems of prospecting are based on the study of resistivity variations. The basic assumption made is that in general changes of resistivity follow the bedding planes. Electrical methods of exploration may be divided into two classes: direct-current methods and alternating-current methods.

In Part II the fundamental theory of direct-current method is discussed and a typical survey is described.

Part III deals with the theory of alternating-current methods, with particular reference to the optimum frequency to be used. It is shown that in general very low frequencies are desirable. Two alternating-current surveys made by the Swedish American Prospecting Corporation are briefly described.

In the conclusion (Part IV) some of the difficulties of electrical prospecting are discussed. The depth to which investigations may be carried is limited. In the present stage of the art, it would take exceptionally favorable conditions to obtain reliable information much in excess of 2,000 feet. However, it is stated that improvements in methods of interpretation and in field technique should give electrical methods a definite field of usefulness in prospecting for oil.--Authors' abstract.

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5. RADIOACTIVE METHODS

(820) NEUE FORSCHUNGEN ÜBER RADIOAKTIVITÄT

(NEW INVESTIGATIONS RELATING TO RADIOACTIVITY)

Editorial note

Petroleum Zeitschrift, Berlin, vol. 28, No. 11, 1932, p. 12.

A brief summary of a lecture delivered by Prof. O. Hahn before the "Verein Deutscher Chemiker" in March, 1932, on the results of his investigations concerning radioactivity is given. According to Hahn the extremely high sensitiveness of the new methods of measurements makes it possible to establish radiation specific for each radio element even in the case of one million millionth part of 1 gram of the substance.

Methods of investigations, especially the emanation method, were discussed.--W. Ayvazoglou.

(821) DAS WESEN DER ULTRASTRAHLUNG

(THE NATURE OF THE PENETRATING RADIATION)

By Jenö Barnothy and Magdalene Forro

Zeitschrift für Physik, Berlin, vol. 71, No. 11/12, 1931, pp. 778-791.

The purpose of this work consisted in examining the influence of the earthmagnetic field on the penetrating radiation.

From the fact of the existence or absence of this influence a conclusion can be drawn as to whether the radiation is of a corpuscular or wave nature. In order to determine this the authors investigated the intensity of distribution of cosmic radiation along the directions perpendicular to the magnetic meridians W. 50° and E. 140°. Maximum of intensity was found at 90° and 120°.

The arrangements of the investigations made according to two methods are described. The results are shown in tables and diagrams.--W. Ayvazoglou.

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(822) DIE SPEZIFISCHE IONISATION DER HÖHENSTRAHLUNG

(SPECIFIC IONIZATION OF THE PENETRATING RADIATION)

By W. Kolhörster and L. Tuwim

Zeitschrift für Physik, Berlin, vol. 73, No. 1/2, 1931, pp. 130-136.

Tuwim's theory of the vertical countertube effect contains a constant N_o which is analogous to the constant J_o in the formula:

$$J = J_o \sqrt{D} \quad (\mu H)$$

derived for the ionization chambers. It is shown that the specific ionization of the penetrating radiation K is equal to:

$$K = J_o / N_o$$

K is calculated from experimental values obtained for J_o and N_o as being equal to 135 ions cm^{-1}, that is three times greater than in the case of the most rapid radioactive β-rays. The specific ionization K allows us to determine the lower limit for the energy of a single radiation ray to be equal to 2.10^9 e volts. This calculation is independent from any hypothetic assumption on the nature and absorption capabilities of the penetrating radiation.--Authors' abstract translated by W. Ayvazoglou.

(823) ZUR VERTEILUNG RADIOAKTIVER STOFFE IN DER FREIEN LUFT

(ON THE DISTRIBUTION OF RADIOACTIVE SUBSTANCES IN THE FREE AIR)

By J. Priebsch

Physikalische Zeitschrift, Leipzig, vol. 32, No. 16, 1931, pp. 622-629.

Based on the laws of the unregulated movement in the free air, the altitude distribution of emanations coming out from the ground, and their products of decomposition were calculated by V. F. Hess and W. Schmidt under the assumption that the interchange value does not depend on the altitude, and later by W. Schmidt under the assumption that the interchange increases with the increase of the altitude.

The very rapid decrease with the altitude calculated by taking into consideration W. Schmidt's later assumption seemed to agree with the observations of the vertical distribution of the radium emanation made by E. Schmidt in Graz, but this could not be considered decisive owing to the abnormal climatic conditions of the Graz basin. An error in Schmidt's calculations was disclosed, and a new calculation carried out for RaEm, ThEm, and ThB resulted in a considerably smaller decrease with the increase of the altitude.--W. Ayvazoglou.

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6. GEOTHERMAL METHODS

(824) ON THE CORRELATION OF ISOGEOTHERMAL SURFACES WITH THE ROCK STRATA

By C. E. Van Orstrand

Physics, Menasha, Wis., vol. 2, No. 2, 1932, pp. 139-153.

Items of the article:

Regional variation of isogeothermal surfaces.
Local variations of isogeothermal surfaces.
Correction for surface topography.
Comments on the data of observation.
Causes of temperature variations.
Some general suggestions.

An instance of regional variation in Oklahoma and two cases of local variation, one at Long Beach, Calif., and the other at Salt Creek, Wyo., have been selected for consideration from a large number of geothermal surveys conducted during the past few years by the U. S. Geological Survey and the American Petroleum Institute. The causes of local and regional variations are unknown. Possible explanation such as radioactivity, proximity to crystalline rocks, and transfer of heat along the strata are given careful consideration in attempting to explain the observed relations between the strata and the isogeothermal surfaces.--Author's abstract.

(825) GEOTHERMAL GRADIENT DETERMINATIONS IN THE LAKE SUPERIOR COPPER MINES

By L. R. Ingersoll

Physics, Menasha, Wis., vol. 2, No. 3, 1932, pp. 154-159.

Contents of the article:

1. Method of temperature measurement: General procedure; thermometers; temperature readings.
2. Results: Theoretical interpretation of results.

The Michigan College of Mining and Technology, in cooperation with the Calumet and Hecla Copper Co. and the author, is carrying out a program of temperature measurements in the deep copper mines of northern Michigan, extending the previous work of Agassiz and others.

Temperatures were measured with mercury thermometers mounted in bakelite tubes, placed in drill holes in mine workings, where the rock has been freshly exposed, special attention being given the effects of drilling, blasting, and other heat-conduction considerations. Present results give

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as the average gradient from the surface to 5,679 feet below (temp. 95.3° F.), 1° F. in 108.5 feet (0.0168° C./ meter). The gradient is more nearly uniform than has sometimes been supposed. A preliminary attempt has been made at calculating the previous "thermal history" of this region. Diffusivity of specimens of the rock measures 0.0075 c.g.s., and on this basis calculations of theoretical temperature-depth curves have been made for 25 different assumptions of previous temperature conditions, and compared with the actual curve. Results as yet are inconclusive but indicate that at least 30,000 years have elapsed since the last glacial epoch, a longer period than usually assumed.--Author's abstract.

(826) EARTH TEMPERATURES OF NORTH-CENTRAL TEXAS

By Virgil E. Barnes

Bulletin of the American Association of Petroleum Geologists, Tulsa, Okla., vol. 16, No. 4, 1932, pp. 413-416.

Temperature gradients, consequently isothermal surfaces, in north-central Texas are controlled by the proximity of the pre-Cambrian rocks to the surface. Unconformities probably also affect temperature gradients only inasmuch as they present angular relationships with better conducting rocks beneath poorer conducting rocks, or under exceptional conditions the reverse may be true. The present study indicates that a feasible explanation for the variation of geothermal gradients over anticlinal structure is the difference in conduction of heat by rocks.--Author's abstract.

(827) OIL-FIELD WATERS OF NORTH-CENTRAL TEXAS

By Virgil E. Barnes

Bulletin of the American Association of Petroleum Geologists, Tulsa, Okla., vol. 16, No. 4, 1932, pp. 409-411.

The mapping of geological structure in north-central Texas is only slightly facilitated by the results derived from the study of oil-field waters. However, application of facts already known can be of much value in regions which contain salt domes, or faults, where strongly saline solutions may approach the surface and intermingle with fresh or slightly saline solutions, thus producing abnormal waters for short distances from such features.--Author's abstract.

(828) MOVEMENTS IN THE EARTH'S CRUST

By J. S. Delury

Canadian Mining Journal, Gardenvale, vol. 53, No. 4, 1932, pp. 161-165.

After a brief discussion of the movements in the earth's crust caused by isostasy, the author says that there is still something missing in crustal theories.

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In this article Delury makes an attempt to answer the question: What is the great force that has always been active in upsetting isostatic balance? This force is evidently great enough to distort the earth and to overcome the power of gravity. The appeal made at different times to astronomic forces, to different contractions of the earth, to a changing form of the geoid brought about by change in rate of rotation, as well as many other possible sources of energy can not, according to the author, be considered sufficiently effective distorting agents.

As heat is available from several sources within the earth the author is exploring the field offered by it for the explanation of earth distortion.

He says: An attempt is made to show that the earth's thermal condition, and its thermal condition in the past as read from geological history, are not in keeping with most conceptions of crustal mechanics, but are in keeping with the hypothesis of sheet-flow in the subcrust. Heat migrates horizontally in the earth, not by conduction, but through the medium of migrating hot material. It is considered possible that heat so carried introduces direct and indirect density effects in the outer earth, so that distortion is produced to upset the conditions of isostatic balance and to initiate in that way changes of level and consequent crustal deformation.

A brief discussion of relevant facts and theories concerning the earth and its crust, as well as an outline of crustal phenomena and structures, is given as a necessary preliminary to the development and application of the hypothesis outlined by the author.--W. Ayvazoglou.

7. UNCLASSIFIED METHODS

(829) PROSPECTION GÉOPHYSIQUE DU SOUS-SOL

(GEOPHYSICAL PROSPECTING OF THE SUBSOIL)

Editorial note

L'Écho des Mines et de la Métallurgie, Paris, vol. 60, No. 3984, 1932, p. 176.

This note mentions the following two articles on geophysical prospecting appearing in the Annales des Mines:

1. Gravimetrical prospecting of the subsoil, by M. H. Galbrun (see Geophys. Abs. No. 36).

2. Seismic prospection of the subsoil, by R. Maillet and J. Bazerque (see Geophys. Abs. No. 35).

The greater number of articles dealing with geophysical methods of prospecting appearing recently in the literature indicates, according to the author, that the importance of these methods is constantly increasing. --W. Ayvazoglou.

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(830) ECONOMIC VALUE OF GEOPHYSICS IN MINING

By C. H. Wilson

The Mining Journal, Phoenix, Arizona, vol. 15, No. 21, 1932, pp. 3-5.

The object of this paper, according to the author, is to indicate the desirability of using corrective measures against the abusive practices often common in the initial stages of a mining enterprise, and to explain the role of geophysics as such a corrective device and an aid in placing mining on a basis more on a par with other enterprises.

The information supplied by geophysical surveys makes it possible to improve the efficiency in the conduct of mining enterprises and to lower the risks involved.

In this discussion the author is chiefly concerned with the problems present in the field of metal mining, the most common being the direct location of sulphide orebodies by virtue of their generally high electrical conductivity. In addition to the direct location of mineralized zones the problems of structural geology, knowledge of which is necessary for the indirect location of mineralized zones, are examined.--W. Ayvazoglou.

(831) WHAT LIES FIVE MILES UNDER SEA?

By Miller James

The Washington Post, Sunday, April 3, 1932, pp. 7 and 13.

The author describes in this article the organization of an expedition which started recently for the West Indies to explore on a large scale the bottom of the ocean. The purpose of the expedition, which is equipped with the most modern apparatus, is to throw new light on the shape of the earth, as well as on the cause of earthquakes,

A newer type of submarine is used, which probably will make possible more satisfactory experiments some 60 to 80 feet below the surface of the sea with Dr. Meinesz' new gravity measuring device.

Prof. Field, who is in charge of the expedition, explained that the region of the Bahamas was selected as the base of operations for the cruise because this section of the world affords a special opportunity for testing conflicting theories on the building up of great mountain ranges, as well as the probable cause of earthquakes and volcanoes.

A brief explanation on how the exact depth of the ocean's floor at any given point can be measured by means of a "fathometer" is given--W. Ayvazoglou.

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(832) THE COMPOSITION OF THE INTERIOR OF THE EARTH

By A. A. Bless

Proceedings of the National Academy of Sciences, Washington, D. C., vol. 17, No. 4, 1931, pp. 225-229.

The object of this paper is to present a theory explaining the high density of the interior of the earth on the basis of the ionization of the elements composing the core, as, according to the author, the iron core theory can not be considered to be very plausible; the composition of the earth must be assumed to be no different from that shown by other celestial bodies. The author concludes: "The paper here presented has for its aim not a dogmatic explanation of the density of the earth, but rather is it an effort to call attention to a new, probably more satisfactory method of attack of the problem."--W. Ayvazoglou.

(833) GEOPHYSICAL STUDIES IN ITALY

By A. Belluigi

Petroleum World, New York, vol. 3, No. 1, 1932, pp. 16-17.

The importance of a serious investigation of the zone flanking the Apennines on the side toward the Adriatic is pointed out. According to investigations on gravimetric relief with the Eötvös balance in the region of San Colombano on the Lambro, noteworthy indications of petroleum and of mineralized water were obtained. The existence of a deep gravimetric anticline with a gravimetric axis running from east to west immediately north of the northern edge of the hill of San Colombano was established. Besides the work done at San Colombano, geophysical studies have disclosed the Emilian sub-Paduan dislocation which is divided by the author into three areas of upheaval: Fontevivo, Montepalato, and Cavriago.

Magnetic characteristics have been noted at the apex of the gravimetric perturbations, and electrical investigations have given useful indications. Geophysical investigation of this buried Emilian dislocation has shown the possibility of discovering petroleum at Fontevivo.--W. Ayvazoglou.

(834) AERIAL PHOTOGRAPHY IN GEOLOGICAL AND GEOPHYSICAL WORK

By Jack Logan

The Oil Weekly, Houston, vol. 64, No. 10, 1932, pp. 17-26.

Aerial surveys are at present employed on an extensive scale by both the geological and geophysical branches of the oil business. In this article Logan gives a discussion on photographic mapping in the petroleum industry under the following headings:

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1. Aiding the geologist.
2. Uses of aerial maps for geologists.
3. The aerial survey as a reconnaissance map.
4. The aerial survey as a guide map.
5. The aerial survey as a base map.
6. Making of photographs for geological study.
7. Uses of aerial surveys in geophysical work.

The aerial photographic map serves for the geophysicist working in the oil industry two principal purposes: In the first place, this map affords valuable aid in carrying out the geophysical exploration, and in the second place, the map constitutes a reliable and convenient base map for permanently recording the results of the exploration work and consequently for correlating work in different localities.

The applicability of photographic maps in connection with the torsion balance surveys and seismic investigations are examined.—W. Ayvazoglou.

8. GEOLOGY

(835) LIMITATIONS OF GROUND WATER AS AID IN DETERMINATION OF HIDDEN GEOLOGIC STRUCTURE

By E. K. Soper

Bulletin of the American Association of Petroleum Geologists, Tulsa, vol. 16, No. 4, pp. 335-360.

The main features of the water table are controlled by the topography. The usefulness of water-table data in searching for buried structure is limited, therefore, to those localities where the surface of the land is relatively flat—consequently, where there is no topographic clue to the underlying structure. Under such conditions, irregularities of the water table such as wide flat terraces, sharply defined artesian areas, or anticlinal bulges may be reliable indicators of the existence and location of buried structure. In making hydrographic contour maps, water levels on piezometric surfaces are sometimes erroneously included with the water-table levels, producing misleading results. Many small but prominent water-table irregularities are the result of local variation in porosity of the water-bearing material, whereas other similar irregularities are due to artificial causes such as intensive pumping of wells or extensive irrigation of some areas. There are large areas in California, on the Gulf coastal plain, and along the Atlantic coastal plain where carefully compiled ground-water data may prove helpful in determining hidden geologic structure when used with the proper limitations.—Author's abstract.

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(836) STRUCTURAL AND COMMERCIAL OIL AND GAS POSSIBILITIES OF CENTRAL VALLEY REGION, CALIFORNIA

By Walter Stalder

Bulletin of the American Association of Petroleum Geologists, Houston, vol. 16, No. 4, 1932, pp. 361-371.

Relationship of the igneous core of the Marysville Buttes to the petroliferous Cretaceous rocks is presented. Lenticular sands, buttress sands, and structural terraces, or low anticlines, around a great bow in the sediments east of Kettleman Hills, afford favorable conditions for accumulation of oil and gas. Evidence of similar general conditions north of Wheeler Ridge is presented and discussed.--Author's abstract.

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9. NEW BOOKS

(837) Bauer, Louis A. and Fleming, John A. Annual report of the director of the Department of Terrestrial Magnetism, Carnegie Institution of Washington. Reprinted from Year Book No. 30 for the year 1930-31, pages 281 to 370, 1 plate. Issued December 10, 1931. Contents: (1) General summary, (2) investigational and experimental work: (a) Terrestrial magnetism and electricity and cosmical relations, (b) research associates and collaborators, (c) magnetism and atomic physics, (d) experimental work in terrestrial electricity, (3) field work and reductions: (a) Land magnetic survey; (b) field-operations and cooperative surveys, (c) observatory-work, (d) ocean work, (e) instrument shop, (4) Miscellaneous activities, (5) abstracts of publications and investigations, (6) bibliography of contributions, (7) personnel.

(838) Conrad, V. and Weickmann, L. Ergebnisse der Kosmischen Physik (Results of cosmic physics), Akademische Verlagsgesellschaft, m.b.H., Leipzig. Vol. 1, 448,pp., 243 figs. Price, M. 46 (for the subscribers of the Gerlands Beiträgen, M. 40.). Contents: (1) On the problems of the aurora polaris, by Carl Störmer, (2) absorption coefficient of the penetrating radiation, b W. Kolhörster and L. Tuwim, (3) the barometer effect of the penetrating radiation, by W. Kolhörster and L. Tuwim, (4) the atmospheric ozone, by F. W. Paul Götz, (5) on the propagation of explosion waves in the earth's atmosphere, (6) new ways for the determination of the figure of the earth, by F. Hopfner, (7) on the dynamic of the forms of movement on the surface of the earth, by F. M. Exner.

(839) Jones, Dr. W. R., and Cissarz, Dr. Arnold. German-English geological terminology. Issued by Thos. Murby and Co., London. 250 pp. Price 12 s. 6 d. net. Many geologists and mining engineers will welcome this volume, as it fills a want which has hitherto remained unsatisfied.

(840) Macelwane, J. B., and Sohon, F. W. Introduction to theoretical seismolog Part II, Seismometry, by F. W. Sohon. 149 pp., $2.75. Publishers, John Wiley and Sons, 440 Fourth Ave., New York City. Contents: (1) Oscillatory motion, (2) the horizontal seismograph, (3) the vertical seismograph (4) the recorder, (5) amplification, (6) friction, (7) galvanometric registration, (8) the onset of a new phase, (9) the tapping test, (10) appendix, miscellaneous graphical methods, identification of phases, Zeissig's method for determining epicenters, solution of spherical triangles, the stereographic projection, (11) tables, (12) index.

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